5.0 CONCLUSIONS

The survival and condition of hatchery-reared juvenile chinook salmon (100 to 170 mm total length, average about 124 mm) in passage over spillbays 3 (unmodified), 4 (I-slot configuration), and 6 (overflow weir) at The Dalles Dam were estimated using the HI-Z tag-recapture technique (balloon tags). These parameters were reliably estimated for only the direct effects of spillway passage at spill of 10,500 cfs (spillbays 3 and 4) and 4,500 cfs (spillbay 6).

The primary criteria set forth by the ACOE, objectives, and assumptions of the experiments were met. A combination of high recapture probabilities (treatment fish ≥0.94 and control >0.96) and high control survival (>0.96) reduced the sample size requirements without sacrificing precision (ε). With the observed recapture and control survival probabilities a paired release of as few as 210 treatment and 105 control fish (spillbay 6) was sufficient to achieve a precision (ε) level of <±4%, 90% of the time. Additionally, the release of a single control group for two treatment groups (spillbays 3 and 4) reduced the number of fish needed for a comparable matched-paired release experiment.

Although recapture probabilities were relatively high and homogeneous between trials within treatment or control groups some variation was observed. The observed variability, particularly due to one treatment trial at spillbay 3, was hypothesized to have been due to entrapment/collision of fish with baffles, vertical end sill, and other hard objects downstream of the spillbay. Stationary radio transmitter signals from the baffle and sill area suggested fish entrapment. A visual inspection may be required to evaluate the physical condition and structural integrity of the baffles, vertical end sill, and other objects and their associated potential effects on fish condition.

The estimated 48 h fish survival probabilities for the three experiments were: 0.993, 90% CI=0.951-1.0 (spillbay 4), 0.99, 90% CI=0.972-1.02 (spillbay 6), and 0.955, 90% CI=0.927-0.982 (spillbay 3). The effects of spillbay configurations *per se* were masked by the differences in spill volume tested and the effects of the baffles and vertical end sill in the stilling basin. However, none of the exit routes, in their present configurations, appear to provide 100% safe fish passage.

The survival probability at spillbay 3 (0.955, 90% CI=0.927-0.982) was lower than reported or assumed (0.98) in most other spill investigations. However, this lowered estimate was most likely due to one treatment trial in which about 16.7% of the fish (5 of 30) transmitted stationary radio signals and possibly were entrapped among the baffles or end sill.

A small proportion of fish suffered visible injuries at all three spillbays. In order of ascending values they were: 0.004 (0.4%) at spillbay 3, 0.015 (1.5%) at spillbay 4, and 0.025 (2.5%) at spillbay 6. Primary injuries observed were hemorrhaging, bruises, and protruding eyes; these were most likely due to contacts with hard surfaces of the spillbays or energy dissipation structures. A lower flow of 4,500 cfs through spillbay 6 may have increased the probability of contacting structures of the spillway. Pressure or shear-related injuries were not readily apparent.

A small release (100) of fish was made at the powerhouse ice and trash sluiceway to obtain an idea on the condition of fish and to identify potential passage problems, if any, to emigrants; no concurrent controls were released. Injury rate on recaptured fish (98 of 100 fish) was 2%. The two injured fish (2 of 98) exhibited scrape/bruise or hemorrhaging gill and both died within 24 h. One of these fish had a bent body suggesting it may have passed through a narrow constricted area within the sluice. However, without a visual inspection of the de-watered sluice this cannot be confirmed.